




Homage to Michel Bornens, who passed away on March 9, 2022 at the age of 84

Bruno Goud^{1,*} , Juliette Azimzadeh² , Nathalie Delgehyr³, Matthieu Piel¹ & Manuel Thery⁴ 

Michel Bornens (Fig 1) was born in 1938 in Paris. His family was originally from the Alps, and he kept a deep attachment to these mountains all his life, spending most of summers in the family home. Although he graduated from Agro-ParisTech, a French “Grande Ecole” that trains engineers in agronomy, Michel was not attracted to a career in this field and devoted himself very early to fundamental research in Biology. During his thesis at the Centre de recherche sur la cellule normale et cancéreuse—CNRS in Villejuif, and his post-doctoral training at the McArdle Laboratory for Cancer Research in Madison (Wisconsin), Michel worked on the biochemistry of proteins and lipids isolated from the nuclear membrane of hepatocytes. Upon his return to France in 1972, he joined the laboratory of Stratis Avraméas in the Department of Molecular Biology of the Pasteur Institute. While he continued his work on nuclear membranes, he observed that images of purified preparations of nuclei often showed the presence of a contaminant, even after treatment with a detergent: the centrosome (Bornens, 1977). Michel liked to say: “Like for most people at that time, the nucleus was the only important organelle for me,” but this “contaminant” became the focus of the rest of his career. The centrosome had been progressively forgotten since its discovery through Theodor Boveri’s famous experiments at the end of the 19th century. The work of Michel placed it at the center of the cell and of the attention of the cell biology community (Bornens, 2019). At the Centre de cytologie expérimentale du CNRS in Ivry/Seine and then at the Centre de



Figure 1. Michel Bornens (1938–2022).

Image by Marie-Berthe Bornens; reproduced with permission.

génomique moléculaire (CGM) in Gif/Yvette, he and his team established what became the standard procedure to purify centrosomes from cultured cells, allowing the production of the first antibodies against centrosomal proteins. He studied all aspects of its composition, structure, and function. If anybody had a question related to the centrosome, Michel was the reference due to his encyclopedic knowledge on this organelle.

In 1995, he joined the Institut Curie at the request of Daniel Louvard and

participated in the foundation of the Cell Biology department (UMR CNRS 144). Michel wanted to promote a vision of metazoan cells as organisms living in the environment of tissues, as opposed to the then-dominant vision of the cell as a bag of enzymes. He also became interested in the role of physical parameters underlying cell organization and the functioning of centrosomes. With Jacques Prost, he was at the origin of the extraordinary development of the Physics/Biology axis at Institut Curie.

1 Institut Curie, Paris, France

2 Institut Jacques Monod, Paris, France

3 Ecole Normale supérieure, Paris, France

4 CEA, Hôpital Saint-Louis, Paris, France

*Corresponding author. E-mail: bruno.goud@curie.fr

DOI 10.15252/embr.202255237 | EMBO Reports (2022) 23: e55237 | Published online 10 May 2022

Their common vision was that of a cell considered as a physical living entity made of components, which had been well studied by soft matter physics: polymers, liquid crystals, and membranes. This field of physics had been made popular thanks to the work of Pierre-Gilles de Gennes. Michel and Jacques reasoned that cell biologists interested in cellular structures (trafficking organelles, cytoskeleton) and physicochemists of the De Gennes school should join forces to renew the biology/physics interface and to build an image of cells as complex entities evolved under the rules of simple physical laws. With the influence of such colleagues, Michel continued his study of the centrosome adopting new approaches, such as micro-patterning of cell adhesion proteins (Théry et al., 2005). This method had been initiated by the Ingber/Whitesides duo at Harvard University, but it became a standard in the cell biology field after Michel's contribution showing how it could be used to "normalize" cultured cells and study their internal organization. This success brought Michel to engage in a field he had probably never thought of integrating.

Retiring from the CNRS in 2007 following a long career in fundamental academic research, he became the scientific director of a start-up company that specializing in micropatterned cell culture substrates.

Michel continued his active contribution to the growing scientific community working on the centrosomes after being appointed Director of Research Emeritus, by focusing on the metazoan primary cilium/centrosome from an evolutionary standpoint. He had started to write a book entitled "The urgency to live," where he developed original ideas on the evolution of cellular individuation mechanisms. The book was unfortunately left incomplete. Hopefully, at least some of the chapters will be published.

Through training many physicists and biologists in his laboratory and his taste for endless scientific discussions, Michel left an original legacy and large impact in cell biology in his wake. He was fully devoted to the study of the centrosomes, while being an open-minded scientist at the same time, curious about almost any topic. When sharing his scientific memories, he would equally cherish his successes and his failures, espe-

cially if they were based on some particularly original (sometimes almost bizarre) ideas, some beautiful experiments or preliminary results that could not be entirely finalized. He enjoyed the singular and found deep inspiration in minute details that he contemplated like precious stones—the conserved ninefold symmetry of centrioles, fruits of the tree of life and rooted in the universality of physical laws.

In addition to being a great scientist, Michel was fully dedicated to the defense of a fundamental public research supported at the highest level. He was always concerned with supporting the recruitment, training, and evolution of young researchers, as many PhD students and postdocs who have worked with him can testify.

References

- Bornens M (1977) Is the centriole bound to the nuclear membrane? *Nature* 270: 80–82
- Bornens M (2019) A moment at the cell centre. *Biol Cell* 111: 294–307
- Théry M, Racine V, Pépín A, Piel M, Chen Y, Sibarita JB, Bornens M (2005) The extracellular matrix guides the orientation of the cell division axis. *Nat Cell Biol* 7: 947–953